

**§ 60.564 Test methods and procedures.**

(a) In conducting the performance tests required in § 60.8, the owner or operator shall use as reference methods and procedures the test methods in appendix A of this part or other methods and procedures specified in this section, except as provided under § 60.8(b). Owners or operators complying with § 60.562-1(a)(1)(i)(D) need not perform a performance test on the control device, provided the control device is not used to comply with any other requirement of § 60.562-1(a).

(1) Whenever changes are made in production capacity, feedstock type or catalyst type, or whenever there is replacement, removal, or addition of a control device, each owner or operator shall conduct a performance test according to the procedures in this section as appropriate, in order to determine compliance with § 60.562-1.

(2) Where a boiler or process heater with a design heat input capacity of 150 million Btu/hour or greater is used, the requirement for an initial performance test is waived, in accordance with § 60.8(b). However, the Administrator reserves the option to require testing at such other times as may be required, as provided for in § 114 of the Act.

(3) The owner or operator shall determine the average organic concentration for each performance test run using the equipment described in § 60.563(a)(4). The average organic concentration shall be determined from measurements taken at least every 15 minutes during each performance test run. The average of the three runs shall be the base value for the monitoring program.

(4) When an absorber is the final unit in the system, the owner or operator shall determine the average specific gravity for each performance test run using specific gravity monitoring equipment described in § 60.563(a)(5). An average specific gravity shall be determined from measurements taken at least every 15 minutes during each performance test run. The average of the three runs shall be the base value for the monitoring program.

(5) When a condenser is the final unit in the system, the owner or operator shall determine the average outlet temperature for each performance test

run using the temperature monitoring equipment described in § 60.563(a)(1). An average temperature shall be determined from measurements taken at least every 15 minutes during each performance test run while the vent stream is normally routed and constituted. The average of the three runs shall be the base value for the monitoring program.

(b) The owner or operator shall determine compliance with the emission concentration standard in § 60.562-1(a)(1)(i)(A) or (b)(1)(iii) if applicable [if not, see paragraph (c) of this section] as follows:

(1) The TOC concentration is the sum of the individual components and shall be computed for each run using the following equation:

$$C_{\text{TOC}} = \sum_{j=1}^n C_j$$

where:

$C_{\text{TOC}}$  = Concentration of TOC (minus methane and ethane), dry basis, ppmv.

$C_j$  = the concentration of sample component  $j$ , ppm.

$n$  = Number of components in the sample.

(i) Method 18 shall be used to determine the concentration of each individual organic component ( $C_j$ ) in the gas stream. Method 1 or 1A, as appropriate, shall be used to determine the sampling site at the outlet of the control device. Method 4 shall be used to determine the moisture content, if necessary.

(ii) The sampling time for each run shall be 1 hour in which either an integrated sample or four grab samples shall be taken. If grab sampling is used, then the samples shall be taken at 15 minute intervals.

(2) If supplemental combustion air is used, the TOC concentration shall be corrected to 3 percent oxygen and shall be computed using the following equation:

$$C_{\text{CORR}} = C_{\text{MEAS}} \times \left( \frac{17.9}{20.9 - \% \text{O}_{2d}} \right)$$

where:

$C_{\text{CORR}}$  = Concentration of TOC corrected to 3 percent oxygen, dry basis, ppm by volume.

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$C_{MEAS}$  = Concentration of TOC (minus methane and ethane), dry basis, ppm by volume, as calculated in paragraph (b)(1) of this section.

$\%O_{2d}$  = Concentration of  $O_2$ , dry basis, percent by volume.

The emission rate correction factor, integrated sampling and analysis procedure of Method 3 shall be used to determine the oxygen concentration ( $\%O_{2d}$ ). The sampling site shall be the same as that of the TOC sample and the samples shall be taken during the same time that the TOC samples are taken.

(c) If paragraph (b) of this section is not applicable, then the owner or operator shall determine compliance with the percent emission reduction standard in § 60.562–1 (a)(1)(i)(A) or (b)(1)(iii) as follows:

(1) The emission reduction of TOC (minus methane and ethane) shall be determined using the following equation:

$$P = \frac{E_{inlet} - E_{outlet}}{E_{inlet}} \times 100$$

where:

P = Percent emission reduction, by weight.

$E_{inlet}$  = Mass rate of TOC entering the control device, kg TOC/hr (lb TOC/hr).

$E_{outlet}$  = Mass rate of TOC, discharged to the atmosphere, kg TOC/hr (lb TOC/hr).

(2) The mass rates of TOC ( $E_i$ ,  $E_o$ ) shall be computed using the following equations:

$$E_i = K_1 \left( \sum_{j=1}^n C_{ij} M_{ij} \right) Q_i$$

$$E_o = K_1 \left( \sum_{j=1}^n C_{oj} M_{oj} \right) Q_o$$

where:

$C_{ij}, C_{oj}$  = Concentration of sample component “j” of the gas stream at the inlet and outlet of the control device, respectively, dry basis, ppmv.

$M_{ij}, M_{oj}$  = Molecular weight of sample component “j” of the gas stream at the inlet and outlet of the control device respectively, g/g-mole (lb/lb-mole).

$Q_i, Q_o$  = Flow rate of the gas stream at the inlet and outlet of the control device, respectively, dscm/hr (dscf/hr).

$$K_1 = 4.157 \times 10^{-8} \frac{[(kg)/g-mole]}{[(g)(ppm)(dscm)]} \left\{ \frac{5.711 \times 10^{-15} [(lb)/(lb-mole)]}{[(lb)(ppm)(dscf)]} \right\}$$

(i) Method 18 shall be used to determine the concentration of each individual organic component ( $C_{ij}$ ,  $C_{oj}$ ) in the gas stream. Method 1 or 1A, as appropriate, shall be used to determine the inlet and outlet sampling sites. The inlet site shall be before the inlet of the control device and after all product recovery units.

(ii) Method 2, 2A, 2C, or 2D, as appropriate, shall be used to determine the volumetric flow rates ( $Q_i$ ,  $Q_o$ ). If necessary, Method 4 shall be used to determine the moisture content. Both determinations shall be compatible with the Method 18 determinations.

(iii) Inlet and outlet samples shall be taken simultaneously. The sampling time for each run shall be 1 hour in which either an integrated sample or four grab samples shall be taken. If grab sampling is used, then the samples shall be taken at 15 minute intervals.

(d) An owner or operator shall determine compliance with the individual stream exemptions in § 60.560(g) and the procedures specified in Table 3 for compliance with § 60.562–1(a)(1) as identified in paragraphs (d)(1) and (2) of this section. An owner or operator using the procedures specified in § 60.562–1(a)(1) for determining which continuous process emissions are to be controlled may use calculations demonstrated to be sufficiently accurate as to preclude the necessity of actual testing for purposes of calculating the uncontrolled annual emissions and weight percent of TOC. Owners or operators seeking to exempt streams under § 60.560(g) must use the appropriate test procedures specified in this section.

(1) The uncontrolled annual emissions of the individual vent stream shall be determined using the following equation:

$$E_{unc} = K_2 \left( \sum_{j=1}^n C_j M_j \right) Q \times 8,600$$

Where:

$E_{unc}$  = uncontrolled annual emissions, Mg/yr (ton/yr)

$C_j$  = concentration of sample component j of the gas stream, dry basis, ppmv

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$M_j$  = molecular weight of sample component  $j$  of the gas stream, g/g-mole (lb/lb-mole)

$Q$  = flow rate of the gas stream, dscm/hr (dscf/hr)

$K_2 = 4.157 \times 10^{-11} [(Mg)(g-mole)] / [(g)(ppm)(dscm)]$  (metric units)

$= 1.298 \times 10^{-12} [(ton)(lb-mole)] / [(lb)(ppm)(dscf)]$  (English units)

8,600 = operating hours per year

(i) Method 18 shall be used to determine the concentration of each individual organic component ( $C_j$ ) in the gas stream. Method 1 or 1A, as appropriate, shall be used to determine the sampling site. If the gas stream is controlled in an existing control device, the sampling site shall be before the inlet of the control device and after all product recovery units.

(ii) Method 2, 2A, 2C, or 2D, as appropriate, shall be used to determine the volumetric flow rate ( $Q$ ). If necessary, Method 4 shall be used to determine the moisture content. Both determinations shall be compatible with the Method 18 determinations.

(iii) The sampling time for each run shall be 1 hour in which either an integrated sample or four grab samples shall be taken. If grab sampling is used, then the samples shall be taken at 15 minute intervals.

(2) The weight percent VOC of the uncontrolled individual vent stream shall be determined using the following equation:

$$\text{weight \% TOC} = \frac{\sum_{j=1}^n C_j M_j}{MW_{\text{gas}} \times 10^6} \times 100$$

where:

$C_j$  = concentration of sample TOC component "j" of the gas stream, dry basis, ppmv.

$M_j$  = Molecular weight of sample TOC component "j" of the gas stream, g/g-mole (lb/lb-mole).

$MW_{\text{gas}}$  = Average molecular weight of the entire gas stream, g/g-mole (lb/lb-mole).

(i) Method 18 shall be used to determine the concentration of each individual organic component ( $C_j$ ) in the gas stream. Method 1 or 1A, as appropriate, shall be used to determine the sampling site. If the gas stream is controlled in an existing control device, the sampling site shall be before the inlet of the control device and after all

product recovery units. If necessary, Method 4 shall be used to determine the moisture content. This determination shall be compatible with the Method 18 determinations.

(ii) The average molecular weight of the gas stream shall be determined using methods approved by the Administrator. If the carrier component of the gas stream is nitrogen, then an average molecular weight of 28 g/g-mole (lb/lb-mole) may be used in lieu of testing. If the carrier component of the gas stream is air, then an average molecular weight of 29 g/g-mole (lb/lb-mole) may be used in lieu of testing.

(iii) The sampling time for each run shall be 1 hour in which either an integrated sample or four grab samples shall be taken. If grab sampling is used, then the samples shall be taken at 15 minute intervals.

(e) The owner or operator shall determine compliance of flares with the visible emission and flare provisions in § 60.562-1 as follows:

(1) Method 22 shall be used to determine visible emissions. The observation period for each run shall be 2 hours.

(2) The monitoring device of § 60.563(b)(2) shall be used to determine whether a flame is present.

(f) The owner or operator shall determine compliance with the net heating value provisions in § 60.18 as referenced by § 60.562-1(a)(1)(i)(C). The net heating value of the process vent stream being combusted in a flare shall be computed as follows:

$$H_T = K_3 \left( \sum_{j=1}^n C_j J_j \right)$$

Where:

$H_T$  = Vent stream net heating value, MJ/scm (Btu/scf), where the net enthalpy per mole of offgas is based on combustion at 25 °C and 760 mm Hg (68 °F and 30 in. Hg), but the standard temperature for determining the volume corresponding to one mole is 20 °C (68 °F).

$K_3 = 1.74 \times 10^{-7}$  (1/ppm)(g-mole/scm)(MJ/kcal) (metric units), where standard temperature for (g-mole/scm) is 20 °C.

$= 4.67 \times 10^{-6}$  (1/ppm)(lb-mole/scf)(Btu/kcal) (English units) where standard temperature for (lb-mole/scf) is 68 °F.

$C_j$  = Concentration on a wet basis of compound  $j$  in ppm.

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$H_j$  = Net heat of combustion of compound  $j$ , kcal/(g-mole) (kcal/(lb-mole)), based on combustion at 25 °C and 760 mm Hg (77 °F and 30 in. Hg).

(1) Method 18 shall be used to determine the concentration of each individual organic component ( $C_j$ ) in the gas stream. Method 1 or 1A, as appropriate, shall be used to determine the sampling site to the inlet of the flare. Using this same sample, ASTM D1946–77 or 90 (Reapproved 1994) (incorporated by reference—see §60.17) shall be used to determine the hydrogen and carbon monoxide content.

(2) The sampling time for each run shall be 1 hour in which either an integrated sample or four grab samples shall be taken. If grab sampling is used, then the samples shall be taken at 15 minute intervals.

(3) Published or calculated values shall be used for the net heats of combustion of the sample components. If values are not published or cannot be calculated, ASTM D2382–76 or 88 or D4809–95 (incorporated by reference—see §60.17) may be used to determine the net heat of combustion of component “j.”

(g) The owner or operator shall determine compliance with the exit velocity provisions in §60.18 as referenced by §60.562–1(a)(1)(i)(C) as follows:

(1) If applicable, the net heating value ( $H_T$ ) of the process vent shall be determined according to the procedures in paragraph (f) of this section to determine the applicable velocity requirements.

(2) If applicable, the maximum permitted velocity ( $V_{max}$ ) for steam-assisted and nonassisted flares shall be computed using the following equation:

$$\text{Log}_{10}(V_{max}) = (H_T + K_4)/K_5$$

Where:

$V_{max}$  = Maximum permitted velocity, m/sec (ft/sec)

$K_4$  = 28.8 (metric units), 1212 (English units)

$K_5$  = 31.7 (metric units), 850.8 (English units)

$H_T$  = The net heating value as determined in paragraph (f) of this section, MJ/scm (Btu/scf).

(3) The maximum permitted velocity,  $V_{max}$ , for air-assisted flares shall be determined by the following equation:

$$V_{max} = K_6 + K_7 H_T$$

Where:

$V_{max}$  = Maximum permitted velocity, m/sec (ft/sec).

$K_6$  = 8.706 m/sec (metric units)

= 28.56 ft/sec (English units)

$K_7$  = 0.7084 [(m/sec)/MJ/scm)] (metric units)

= 0.00245 [(ft/sec)/Btu/scf)] (English units)

$H_T$  = The net heating value as determined in paragraph (f) of this section, MJ/scm (Btu/scf).

(4) The actual exit velocity of a flare shall be determined by dividing the volumetric flow rate (in units of standard temperature and pressure), as determined by Method 2, 2A, 2C, or 2D as appropriate, by the unobstructed (free) cross sectional area of the flare tip.

(h) The owner or operator shall determine compliance with the mass emission per mass product standards in §§60.560(d) and (e) and in §§60.562–1(b)(1)(i), (c)(1)(i)(A), (c)(1)(ii)(A), (c)(2)(i), and (c)(2)(ii)(A).

(1) The emission rate of TOC shall be computed using the following equation:

$$ER_{TOC} = K_5 \frac{E_{TOC}}{P_p}$$

Where:

$ER_{TOC}$  = Emission rate of total organic compounds (minus methane and ethane), kg TOC/Mg (lb TOC/ton) product

$E_{TOC}$  = Emission rate of total organic compounds (minus methane and ethane) in the sample, kg/hr (lb/hr)

$P_p$  = The rate of polymer production, kg/hr (lb/hr)

$K_5$  = 1,000 kg/Mg (metric units)

= 2,000 lb/ton (English units)

(2) The mass rate of TOC,  $E_{TOC}$ , shall be determined according to the procedures, as appropriate, in paragraph (c)(2) of this section. The sampling site for determining compliance with §§60.560 (d) and (e) shall be before any add-on control devices and after all product recovery devices. Otherwise, the sampling site shall be at the outlet of the control device.

(3) The rate of polymer production,  $P_p$ , shall be determined by dividing the weight of polymer pulled (in kg (lb)) from the process line during the performance test by the number of hours taken to perform the performance test. The weight of polymer pulled shall be determined by direct measurement or,

subject to prior approval by the Administrator, computed from materials balance by good engineering practice.

(i) The owner or operator shall determine continuous compliance with the temperature requirements in §§ 60.562-1(b)(1)(ii) and 60.562-1(c)(1)(i)(B) by using the temperature monitoring equipment described in § 60.563(a)(1). An average temperature shall be determined from measurements taken at least every 15 minutes every three hours while the vent stream is normally routed and constituted. Each three-hour period constitutes a performance test.

(j) For purposes of determining compliance with § 60.562-1(c) (1)(ii)(B), (1)(ii)(C), (2)(ii)(B), or (2)(ii)(C), the ethylene glycol concentration in either the cooling tower or the liquid effluent from steam-jet ejectors used to produce a vacuum in the polymerization reactors, whichever is applicable, shall be determined:

(1) Using procedures that conform to the methods described in ASTM D2908-74 or 91, "Standard Practice for Measuring Volatile Organic Matter in Water by Aqueous-Injection Gas Chromatography" (incorporated by reference—see § 60.17), except as provided in paragraph (j)(2) of this section:

(i) At least one sample per operating day shall be collected using the grab sampling procedures of ASTM D3370-76 or 96a, "Standard Practices for Sampling Water" (incorporated by reference—see § 60.17). An average ethylene glycol concentration by weight shall be calculated on a daily basis over a rolling 14-day period of operating days, except as provided in paragraphs (j)(1)(ii) and (iii) of this section. Each daily average ethylene glycol concentration so calculated constitutes a performance test. Exceedance of the standard during the reduced testing program specified in paragraphs (j)(1)(ii) and (iii) of this section is a violation of these standards.

(ii) For those determining compliance with § 60.562-1(c) (1)(ii)(B) or (2)(ii)(B), the owner or operator may elect to reduce the sampling program to any 14 consecutive day period once every two calendar months, if at least seventeen consecutive 14-day rolling average concentrations immediately

preceding the reduced sampling program are each less than 0.10 weight percent ethylene glycol. If the average concentration obtained over the 14 day sampling during the reduced testing period exceeds the upper 95 percent confidence interval calculated from the most recent test results in which no one 14-day average exceeded 0.10 weight percent ethylene glycol, then the owner or operator shall reinstitute a daily sampling program. A reduced sampling program can be reinstituted if the requirements specified in this paragraph are met.

(iii) For those determining compliance with § 60.562-1(c)(1)(ii)(C) or (c)(2)(ii)(C), the owner or operator may elect to reduce the sampling program to any 14 consecutive day period once every two calendar months, if at least seventeen consecutive 14-day rolling average concentrations immediately preceding the reduced sampling program are each less than 1.8 weight percent ethylene glycol. If the average concentration obtained over the 14 day sampling during the reduced test period exceeds the upper 95 percent confidence interval calculated from the most recent test results in which no one 14-day average exceeded 1.8 weight percent ethylene glycol, then the owner or operator shall reinstitute a daily sampling program. A reduced program can be reinstituted if the requirements specified in this paragraph are met.

(iv) The upper 95 percent confidence interval shall be calculated using the equation:

$$CI_{95} = \frac{\sum_{i=1}^n X_i}{n} + 2 \sqrt{\frac{n \sum_{i=1}^n X_i^2 - \left( \sum_{i=1}^n X_i \right)^2}{n(n-1)}}$$

Where:

$X_i$  = daily ethylene glycol concentration for each day used to calculate the 14-day rolling average used in test results to justify implementing the reduced testing program.

$n$  = number of ethylene glycol concentrations.

(2) Measuring an alternative parameter, such as carbon oxygen demand or biological oxygen demand, that is demonstrated to be directly proportional to

the ethylene glycol concentration. Such parameter shall be measured during the initial 14-day performance test during which the facility is shown to be in compliance with the ethylene glycol concentration standard whereby the ethylene glycol concentration is determined using the procedures described in paragraph (j)(1) of this section. The alternative parameter shall be measured on a daily basis and the average value of the alternative parameter shall be calculated on a daily basis over a rolling 14-day period of operating days. Each daily average value of the alternative parameter constitutes a performance test.

[55 FR 51035, Dec. 11, 1990; 56 FR 9178, Mar. 5, 1991, as amended at 56 FR 12299, Mar. 22, 1991; 64 FR 11541, Mar. 9, 1999; 65 FR 61767, Oct. 17, 2000]

**§ 60.565 Reporting and recordkeeping requirements.**

(a) Each owner or operator subject to the provisions of this subpart shall keep an up-to-date, readily-accessible record of the following information measured during each performance test, and shall include the following information in the report of the initial performance test in addition to the written results of such performance tests as required under § 60.8. Where a control device is used to comply with § 60.562-1(a)(1)(i)(D) only, a report containing performance test data need not be submitted, but a report containing the information in § 60.565(a)(11) is required. Where a boiler or process heater with a design heat input capacity of 150 million Btu/hour or greater is used to comply with § 60.562-1(a), a report containing performance test data need not be submitted, but a report containing the information in § 60.565(a)(2)(i) is required. The same information specified in this section shall be submitted in the reports of all subsequently required performance tests where either the emission control efficiency of a combustion device or the outlet concentration of TOC (minus methane and ethane) is determined.

(1) When an incinerator is used to demonstrate compliance with § 60.562-1, except § 60.562-1(a)(2):

(i) The average firebox temperature of the incinerator (or the average tem-

perature upstream and downstream of the catalyst bed), measured at least every 15 minutes and averaged over the performance test period, and

(ii) The percent reduction of TOC (minus methane and ethane) achieved by the incinerator, the concentration of TOC (minus methane and ethane) (ppmv, by compound) at the outlet of the control device on a dry basis, or the emission rate in terms of kg TOC (minus methane and ethane) per Mg (lb TOC/ton) of product at the outlet of the control device, whichever is appropriate. If supplemental combustion air is used, the TOC concentration corrected to 3 percent oxygen shall be recorded and reported.

(2) When a boiler or process heater is used to demonstrate compliance with § 60.562-1, except § 60.562-1(a)(2):

(i) A description of the location at which the vent stream is introduced into the boiler or process heater, and

(ii) For boilers or process heaters with a design heat input capacity of less than 150 million Btu/hr, all 3-hour periods of operation during which the average combustion temperature was more than 28 °C (50 °F) below the average combustion temperature during the most recent performance test at which compliance was determined.

(3) When a flare is used to demonstrate compliance with § 60.562-1, except § 60.562-1(a)(2):

(i) All visible emission readings, heat content determinations, flow rate measurements, and exit velocity determinations made during the performance test,

(ii) Continuous records of the pilot flame heat-sensing monitoring, and

(iii) Records of all periods of operations during which the pilot flame is absent.

(4) When an incinerator, boiler, or process heater is used to demonstrate compliance with § 60.562-1(a)(2), a description of the location at which the vent stream is introduced into the incinerator, boiler, or process heater.

(5) When a flare is used to demonstrate compliance with § 60.562-1(a)(2):

(i) All visible emission readings made during the performance test,

(ii) Continuous records of the pilot flame heat-sensing monitoring, and